P-63

Influence of quantity of amino-acid residues in the oligopeptides based on glycine on their self-organization in films

A.S. Morozova[1], C.A. Ziganshina[2], M.A. Ziganshin[1], A.A. Bukharaev[1,2]

[1]*Kazan Federal University, 420008, Kazan, Russia*
e-mail: morozova_anna_s@mail.ru

[2]*Zavoisky Physical-Technical Institute, Federal Research Center «Kazan Scientific Center of Russian Academy of Sciences», 420029, Kazan, Russia*

At last time the considerable interest of researchers is attracted to shortchain peptides (oligopeptide). Materials on their basis are biocompatible, they have the increased thermal stability and biological activity. A key feature of oligopeptides is their ability to self-organization with formation of various structures: nanoparticles, nanofibres, nanorods, nanowires, nanotubes, nanospheres, nanobubbles etc [1,2]. Glycine is a part of many proteins and the biologically active compounds. In a human body glycine used as an energy source and participates in glucose synthesis, plays an important role in functioning of a brain [3]. Di- and tripeptides based on glycine are also biologically active compounds, represents the glycine source in a human body. The studies of properties of oligopeptides based on glycine (glycyl-glycin and glycyl-glycyl-glycin) are of great interest due to the possibility of its use for production of the biologically active compounds and drugs.

At present work using the atomic-force microscopy (AFM) the self-organization di- and tripeptide based on glycine in a film on various substrates under the influence of vapors of organic compounds (alcohols, nitrogen compound and chlorderivatives) and water was studied.

Dipeptide glycyl-glycine (GG) and a tripeptide glycyl-glycyl-glycin (GGG) were used as objects. Three smooth substrates with differing properties were used: hydrophobic highly oriented pyrolytic graphite (HOPG), hydrophilic mica and monocrystal silicon. Monocrystal silicon have the hydrophilic surface, however, unlike a fresh surface of mica, does not carry on itself the negative charge.

AFM images of films of GG and GGG on mica, HOPG and silicon were obtained. It was established that the substrate has a significant influence on morphology of initial film of di- and a tripeptide. Moreover, depending on a way of film preparation the morphology of its surface is various. So, on a surface of HOPG and mica di- and a tripeptide form amorphous films. While dropping the GG solution on silicon surface with the spontaneous solvent evaporation leads to the formation of layered nanocrystals. According to a powder x-ray diffractometry these crystals represent an alpha phase of dipeptide. The investigation of the influence of vapors of organic compounds and water requires the formation of amorphous films on all substrates. For this purpose the special techniques of the formation of oligopeptides amorphous films on HOPG, mica and silicon were developed.

Depending on the nature of the interacted vaporous compounds the layered nanocrystals, nanocrystals collected from fibers and nanospheres are formed on a surface of diglycine and triglycine films. After the saturation of the GGG film deposited on silicon with ethanol vapors (Fig. 1d) rectangular crystals (from 800 nm to 4 μm length, from 750 nm to 3 μm width) were received and the ways of the masstransfer of tripeptide to crystal are visible. The ethanol vapors occurs the significant effect on the dipeptide film deposited on silicon substrate. After influence of these vapors on a film of GG the flat crystalline structures of a triangular and trapezoidal shape with clear boundaries are received. Nanostructures form the beams dispersing from the center of a circle. Width and length of crystals in the center are 150 – 400 nm and 200 – 900 nm respectively. During moving away from the center of the circle the shape of crystals becomes triangular, length increases to 0,9 – 8 μm, width is 0,3 – 1 μm and 1,5 – 2,5 μm in narrow and wide sides of a trapeze.

The received results show that the type of substrate and the nature of vapors of organic compounds have a significant effect on a shape of the nanostructures formed during the self-organization of oligopeptides.

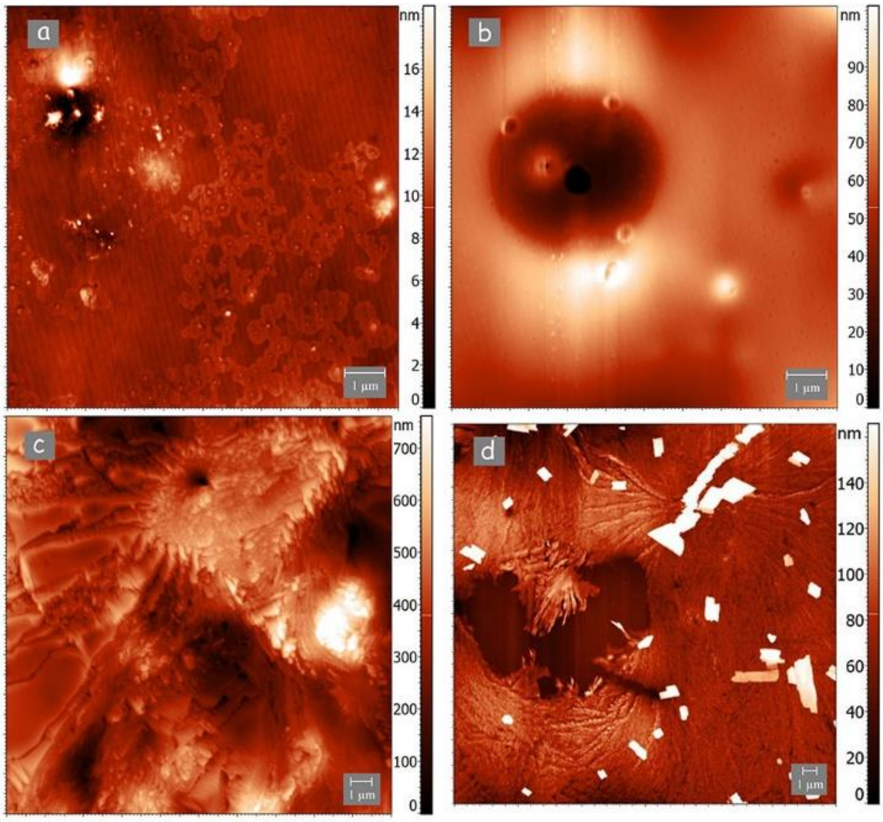

Figure 1. AFM images of (a, c) GG and (b, d) GGG films formed on silicon (a, b) before and (c, d) after the interaction with ethanol vapors.

1. C. Guo, Y. Luo, R. Zhou, et al., *Nanoscale* **6**, 2800 (2014).
2. A.M. Smith, E.F. Banwell, W.R. Edwards, et al., *Adv. Funct. Mater*. **16**, 1022 (2006).
3. N. Habibi, N. Kamaly, A. Memic, et al., *Nano Today* **11**, 41 (2016).